CLAIMS

1. A clothless invertible filter centrifuge for separating a suspension into a filtrate and solids, the filter centrifuge comprising

a centrifugal drum rotatably mounted in a drum housing and having a drum wall comprising a stationary, dimensionally stable filtering medium, the drum further comprising an edge with an open end, a closed end wall, and an interior;

a shaft driving the drum for rotation thereof;

a lid hermetically sealing the open end of the drum at the edge thereof;

a filling pipe leading into the interior of the drum, said filling pipe being disposed to feed the suspension into the interior of the drum;

a drum base disposed in the interior of the drum, which drum base and the filtering medium are axially displaceable relatively to each other from a withdrawn position in order to mechanically discharge at least a portion of the solids retained by the filtering medium out of the drum, the drum base having a peripheral surface and a sealing member at said peripheral surface, which member bears sealingly against the wall of the drum adjacent the closed end wall of the drum when the drum base is in said withdrawn position;

and a pneumatic contrivance for detaching and discharging residue remaining of the solids.

2. The centrifuge as defined in claim 1, wherein the drum has an inside diameter at its closed end wall, and the drum base has a diameter only slightly smaller than the inside diameter of the drum at its closed end wall.

3. The centrifuge as defined in claim 1, wherein the filtering medium is self-supporting.

4. The centrifuge as defined in claim 1, wherein the filtering medium is made of metal, ceramics, plastics or a mixture of these materials.

5. The centrifuge as defined in claim 1, wherein the pneumatic contrivance produces a gas stream in an axial direction of the drum.

6. The centrifuge as defined in claim 1, wherein the pneumatic contrivance produces a gas stream in a radial direction of the drum.

7. The centrifuge as defined in claim 1, wherein operation of the pneumatic contrivance can be synchronized with the relative movement of the drum base and drum wall.

8. The centrifuge as defined in claim 7, wherein the pneumatic contrivance and the drum wall are movable relative to each other in an axial direction of the drum.

9. The centrifuge as defined in claim 1, wherein the pneumatic contrivance produces a pulsating stream of gas.

10. The centrifuge as defined in claim 1, wherein the drum rotates at a first speed of rotation, and the pneumatic contrivance comprises nozzle-type outlets for providing a stream of gas, said nozzle-type outlets capable of being driven for rotation thereof at a different speed of rotation from said first speed.

11. The centrifuge as defined in claim 1, wherein the pneumatic contrivance comprises nozzle-type outlets disposed in the interior of the drum.

12. The centrifuge as defined in claim 11, wherein at least some of the nozzle-type outlets of the pneumatic contrivance disposed in the interior of the drum are located in the drum base.

13. The centrifuge as defined in claim 1, wherein outlets are provided in the interior of the drum for rinsing the drum wall with a liquid cleaning agent.

14. The centrifuge as defined in claim 1, wherein the lid is rigidly connected to the drum base via spacers.

15. The centrifuge as defined in claim 1, wherein the drum housing widens conically in a direction extending from the open end of the drum toward the closed end wall thereof.

16. The centrifuge as defined in claim 1, wherein the drum wall has a slightly conical shape and widens toward its open end.

17. The centrifuge as defined in claim 1, wherein the lid has an opening for accommodation of the filling pipe, the filling pipe having an outlet end located inside the drum during centrifugation.

18. The centrifuge as defined in claim 17, wherein the filling pipe can be connected to at least one of a pressure source and vacuum source to vary a pressure within the drum, the filling pipe being maintained in sealed relationship with the lid by means of a combined rotary/gliding seal, the rotary seal sealing the filling pipe relative to the lid as the lid rotates and the gliding seal sealing the pipe relative to the lid when the lid is displaced axially.

19. The centrifuge as defined in claim 18, wherein the filling pipe is supported on the housing in a resilient mounting which allows for tumbling motion of the filling pipe in conjunction with the rotary/gliding seal.

20. The centrifuge as defined in claim 17, wherein the filling pipe is held in the opening of the lid by a rotary/gliding seal which comprises a sleeve which is equipped with at least one of sealing rings and wiping rings and is rotatably mounted in a bush fixed to the lid.

21. The centrifuge as defined in claim 20, wherein the filling pipe has a thickened region at its outlet end which tapers off on both sides.

22. The centrifuge as defined in claim 17, wherein the opening in the lid can be hermetically sealed by a sealing element which rotates together with the drum and does not engage the filling pipe.

23. The centrifuge as defined in claim 22, wherein the drum can be connected to at least one of a pressure source and a vacuum source by a pipe leading from the end of the drum remote from the filling pipe.

24. The centrifuge as defined in claim 22, wherein the drum is mounted on a hollow shaft and the sealing element is displaceably mounted in said shaft such that the sealing element forms a tight seal between the opening and the interior of the drum.

25. The centrifuge as defined in claim 17, wherein the filling pipe is rotatably mounted about its longitudinal axis and can be set in rotation about said axis together with the drum.

26. The centrifuge as defined in claim 25, wherein the filling pipe can be rotated substantially synchronously with the drum by a drive means.

27. The centrifuge as defined in claim 25, further comprising a sealing element capable of being selectively moved to an open or closed position, the sealing element being arranged so as to provide a seal between the opening in the lid and the filling pipe.

28. The centrifuge as defined in claim 1, wherein the drum and the lid are axially displaceable relatively to each other by means of a rotated hollow shaft and a supporting shaft capable of being reciprocated therein, in order to displace the drum base to mechanically discharge at least a portion of the solids retained by the filtering medium out of the drum.

29. The centrifuge as defined in claim 28, further comprising a screw spindle disposed on the supporting shaft and a nut engaging said screw spindle, either the screw spindle or the nut being rotatable by a motor such that the supporting shaft telescopes to and fro in the hollow shaft depending on a rotational speed of the screw spindle or nut relative to a rotational speed of the hollow shaft.

30. The centrifuge as defined in claim 1, further comprising a safety device which prevents opening of the drum due to removal of the lid therefrom as long as the drum rotates at a rotational speed higher than a critical limit above which opening of the drum would be hazardous, the drum and lid being axially displaceable relatively to each other by means of a rotated hollow shaft or a supporting shaft telescoping to and fro therein, in order to mechanically discharge at least a portion of the solids retained by the filtering medium out of the drum by means of the drum base.

31. The centrifuge as defined in claim 30, further comprising a screw spindle disposed on the supporting shaft and a nut engaging the screw spindle, at least one of the screw spindle or the nut being rotatable by a motor such that the supporting shaft telescopes to and fro in the hollow shaft depending on a rotational speed of the screw spindle or nut relative to the rotational speed of the hollow shaft and drum, the drum lid opening when the rotational speed of the screw spindle or nut driven by the motor is higher than the rotational speed of the hollow shaft and closes when the rotational speed of the screw spindle or nut is lower than the rotational speed of the hollow shaft, a

maximum speed of the motor is such that the maximum speed imparted by said motor to the screw spindle or nut is lower than the critical speed of the drum, so that the drum opens only when the drum rotates at a speed lower than the critical speed.

32. The centrifuge as defined in claim 31, wherein the screw spindle or nut can be driven at different speeds by a plurality of motors which can be switched on selectively, and the maximum speeds of said plurality of motors being such that the maximum speeds imparted by said plurality of motors to the screw spindle or nut are lower than the critical speed of the drum.

33. The centrifuge as defined in claim 1, wherein a flexible and/or expandable partition wall is disposed between the closed end wall of the centrifugal drum and the drum base movable relatively thereto, and the drum base being carried on a sliding shaft, said partition wall forming a seal between the sliding shaft carrying the drum base and the interior of the centrifugal drum receiving the suspension.

34. The centrifuge as defined in claim 33, wherein the partition wall is in the form of bellows which surrounds the sliding shaft ring and is fixed to the closed end wall at one end and to the drum base at the other.

35. The centrifuge as defined in claim 33, further comprising means for monitoring a differential pressure of pressures prevailing on opposite sides of the partition wall.

36. The centrifuge as defined in claim 1, further comprising a device for performing weighing measurements in a weighing process, the centrifuge being mounted for tilting in a vertical plane, a force-measuring member sensing weight-dependent tilting movements of the centrifuge, and compensating means balancing out disruptive forces caused by fluctuating gas pressures such that the weighing process is not affected thereby, the

compensating means further comprising a sensor for sensing the gas pressure in the centrifuge, said sensor generating a correcting signal for the weighing readings in accordance with sensed changes in the gas pressure.

37. The centrifuge as defined in claim 36, wherein said centrifuge can be turned about a horizontal axis of rotation.

38. The centrifuge as defined in claim 1, further comprising a centrifuge housing comprising a first chamber having an outlet for discharging a filtrate and a second chamber having an outlet for mechanically discharging at least a portion of the solids retained by the filtering medium, the first chamber being sealingly enclosed by a first self-contained housing section and the second chamber being sealingly enclosed by a second self-contained housing section, the two housing sections further each being mounted for turning in different directions about separate axes so that said housing sections can be turned separately between a closed state and an open state relative to the centrifugal drum.

39. The centrifuge as defined in claim 38, wherein the two housing sections can be turned about vertical axes.

40. The centrifuge as defined in claim 38, wherein the first housing section has a general annular shape and the second housing section has a general cup shape having a substantially closed end wall, and that when the second housing section is closed it bears closely against the first housing section by means of an edge remote from the end wall.

41. The centrifuge as defined in claim 1, wherein there is an annular gap between the drum housing and the centrifugal drum at the edge of the drum in the region of a filtrate housing section and a solids housing section, the centrifuge further comprising protective means for producing a stream of a gaseous blocking medium in the annular gap surrounding the edge of the drum, the

blocking medium preventing transfer of gaseous, liquid and/or solid substances between the filtrate housing section and the solids housing section.

42. The centrifuge as defined in claim 41, wherein two streams of the gaseous blocking medium can be produced in the annular gap, of which one said gaseous blocking medium is directed into the filtrate housing section and the other said gaseous blocking medium is directed into the solids housing section.

43. The centrifuge as defined in claim 41, further comprising a gas-shuttle pipe having a shut-off valve disposed between the filtrate housing section and the solids housing section.

44. The centrifuge as defined in claim 1, further comprising a downstream solids dryer, dehumidification and drying of solids taking place in the centrifugal drum by centrifuging, compression with pressurized gas and heat convection induced by a stream of drying gas, and in the solids dryer by heat convection induced by a stream of drying gas.

45. The centrifuge as defined in claim 44, wherein the invertible filter centrifuge and solids dryer are joined to form a unit by sealing means causing the centrifuge and dryer to be sealingly separated from each other, sensors being arranged on the inverted filter centrifuge and solids dryer to measure and provide readings of the extent to which dehumidification and drying has taken place therein and other operating characteristics associated therewith, joint control means which can be actuated in accordance with the readings provided by the sensors and, depending on these, adjust operating data, the control means automatically adjusting said operating data whereby operating times for dehumidification and drying in the centrifuge and in the solids dryer are co-ordinated, and mechanical centrifuging energy and thermal energy in

the centrifuge and the dryer being simultaneously allotted so as to give an economic optimum.

46. The centrifuge as defined in claim 1, wherein the centrifuge further comprises a centrifuge housing and a device for undertaking weighing measurements, the centrifuge housing being mounted for turning about a swivel axis, and the device for undertaking weighing measurements comprising a measurement display, a force-measuring member adapted to sense weight-dependent deflections of the centrifuge housing about said swivel axis, said deflections being caused by at least one of different degrees of filling of the drum with suspension or different degrees of dehumidification of the solids of the suspension, the deflections being indicated on the measurement display, a pipe being provided to produce superatmospheric pressure or subatmospheric pressure in the drum, and the line of action of force generated in said pipe due to said super- or sub-atmospheric pressure being directed so that said line of action intersects the axis of rotation of the centrifuge housing.

47. The centrifuge as defined in claim 1, further comprising a centrifuge housing adapted to be turned about a swivel axis, and a force-measuring member capable of sensing weight-dependent deflections of the centrifuge housing about said swivel axis, as caused by at least one of different degrees of filling of the drum with suspension and different degrees of dehumidification of the solids of the suspension, a reading of the deflections being indicated on a measurement display, and a pipe being provided to produce a superatmospheric or subatmospheric pressure in the drum, and a sensor for sensing the pressure in the drum, said sensor producing a correcting signal by means of which the reading can be corrected in accordance with the pressure.

48. A method of separating a suspension into a filtrate and solids using a clothless invertible filter centrifuge according to claim 1, wherein the suspension is conveyed through the filling pipe into the interior of the drum, the filtrate passing through the filtering medium by virtue of centrifugal forces prevailing

when the drum rotates, the solids component being retained by the filtering medium on the drum wall, and wherein, mechanically discharging of the solids using the drum base, pneumatically removing residues of the solids left on the filtering medium by means of streams of gas acting in at least one of a radial and axial direction.

49. The method as defined in claim 48, wherein, prior to the mechanically discharging step, causing streams of gas to flow through the filtering medium toward the interior of the drum in order to loosen the solids.

50. The method as defined in claim 49, wherein the causing the streams of gas step comprises creating a subatmospheric pressure in the interior of the drum.

51. The method as defined in claim 49, wherein the causing the streams of gas step comprises generating at least one pressure or vacuum pulses.

52. The method as defined in claims 48, wherein said streams of gas acting in said radial direction are produced while the drum base is moved from a starting position to an ejecting position adjacent the open end of the drum.

53. The method as defined in claim 52, wherein the streams of gas acting in said radial direction are produced progressively from a position adjacent the starting position of the drum base toward said ejecting position, synchronously with the movement of the drum base.

54. The method as defined in claim 52, wherein steady streams of gas acting in said radial direction are produced when the drum rotates.

55. The method as defined in claim 52, wherein streams of gas acting in said axial direction are superimposed on the streams of gas acting in said radial direction.

56. The method as defined in claim 48, wherein the streams of gas acting in said axial direction are produced synchronously with the movement of the drum base from a starting position to an ejecting position and travelling with it.